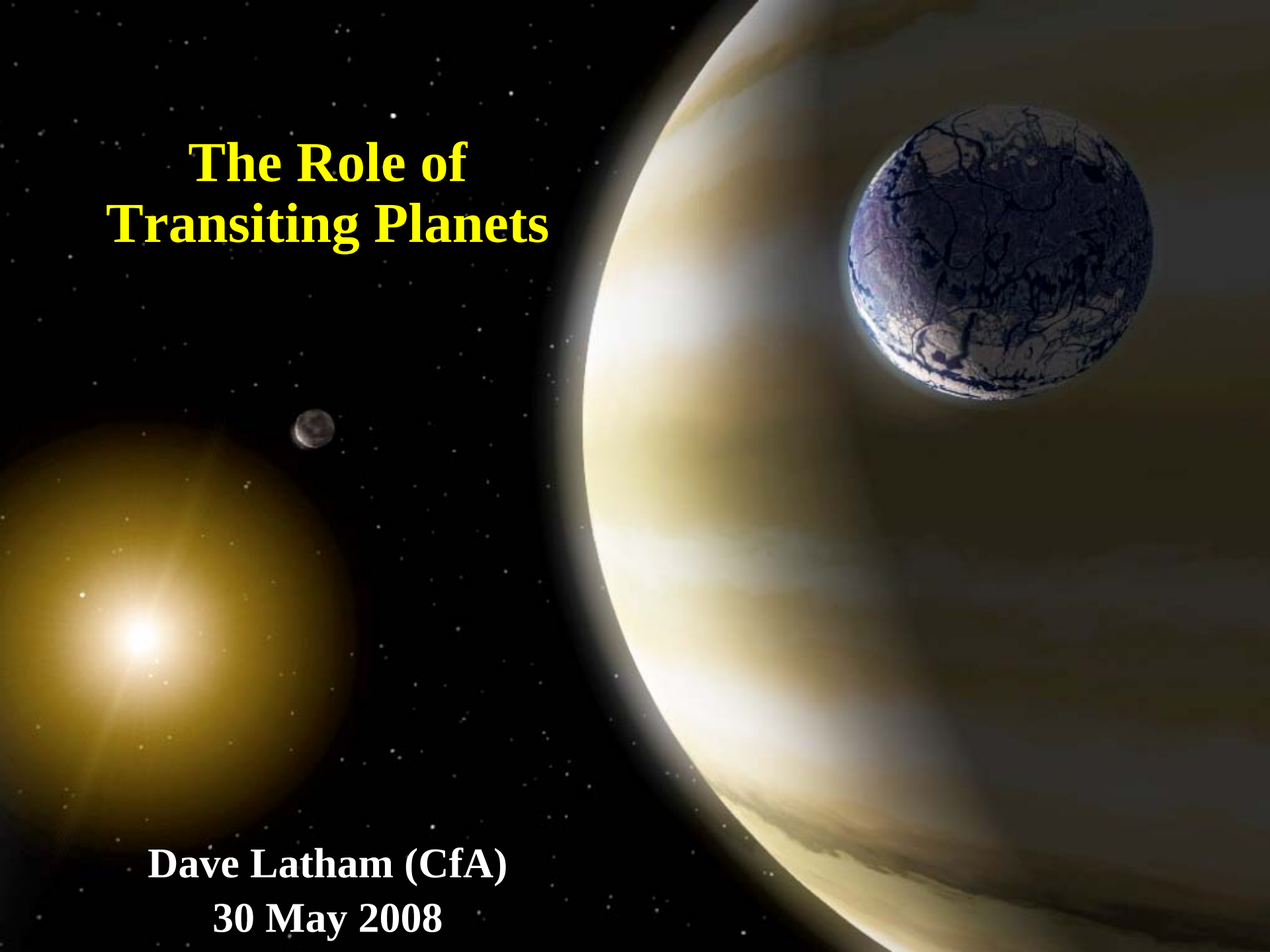


The Role of Transiting Planets

Dave Latham (CfA)

30 May 2008

The Role of Transiting Planets

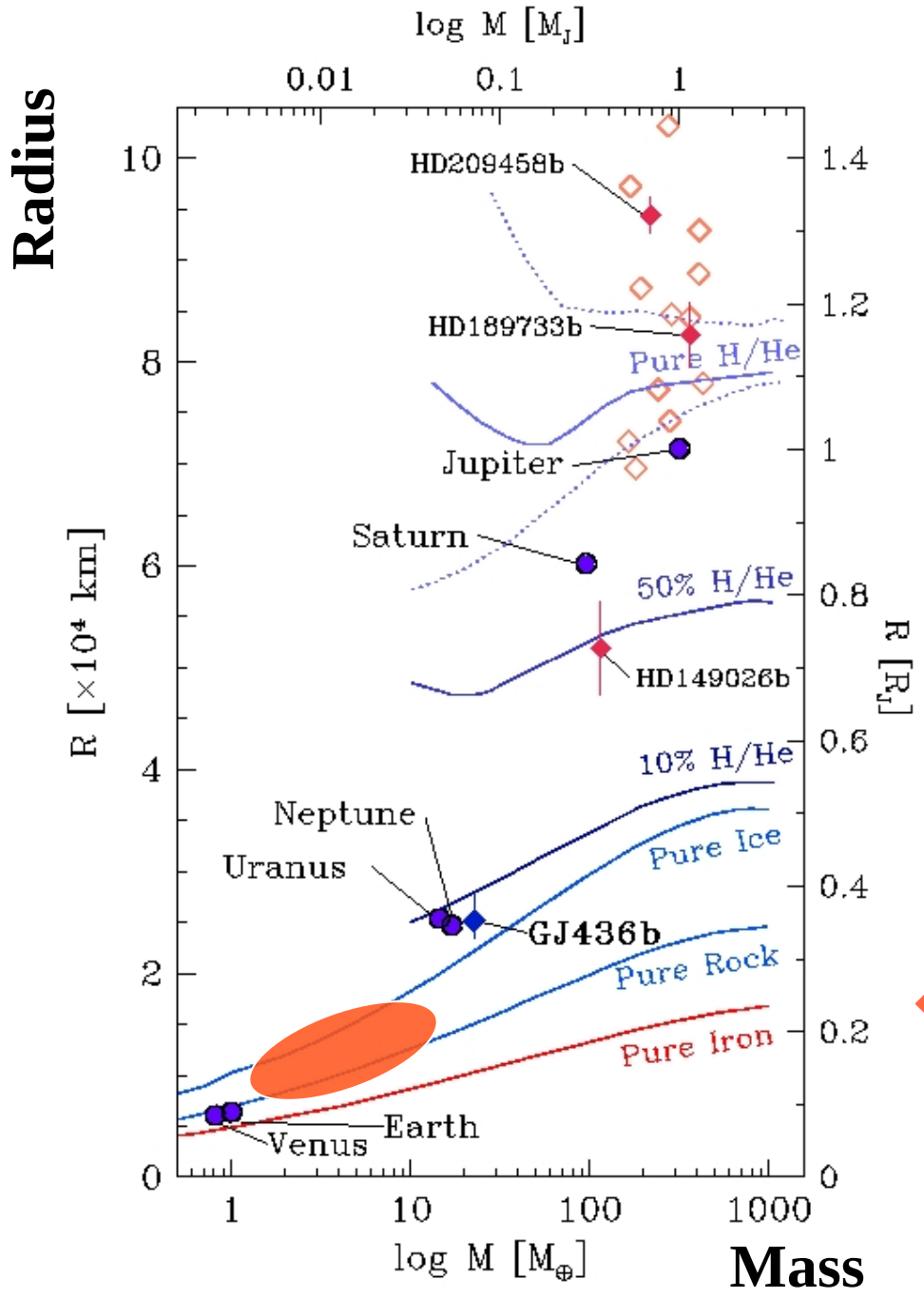
IAU Symposium 253 “Transiting Planets”

(Last week in Cambridge)

TRANSITING PLANETS ARE NOW!

A deluge of new observations and ideas

Mass vs. Radius



Hot Jupiters

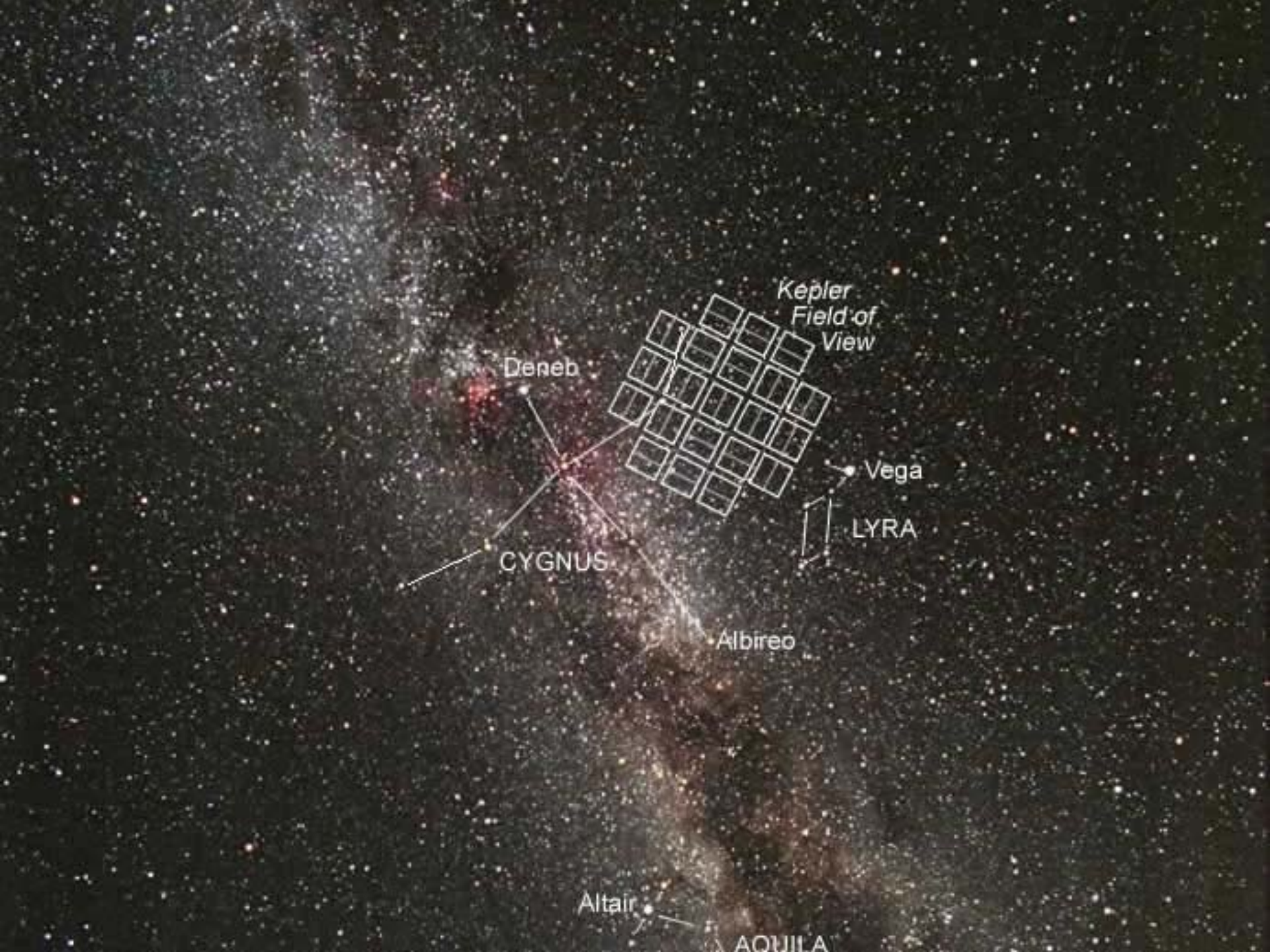
Super-Earths

Mass range:
1 - 10 Earth mass

(GJ 436b: Gillon et al. 2007)

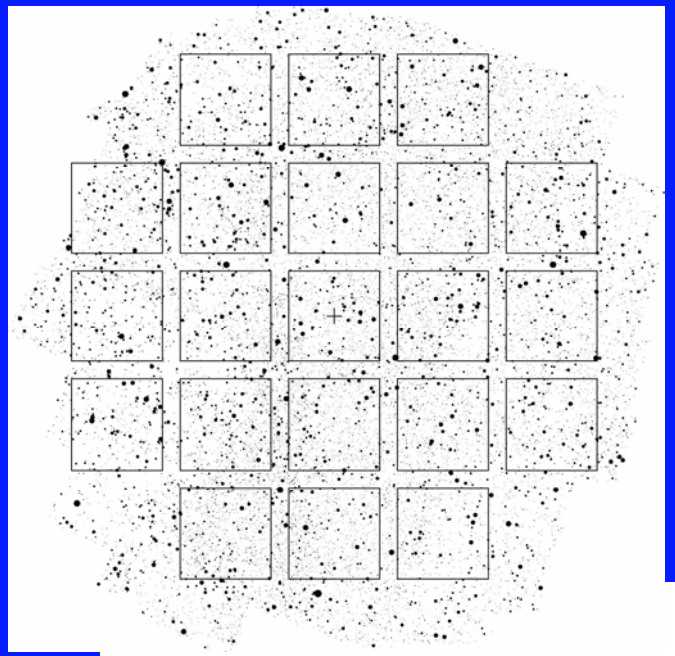
The Near Future

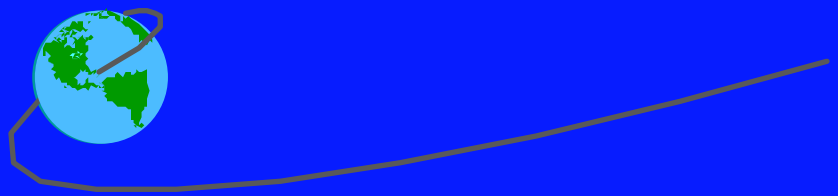
- Radial velocity surveys of FGK stars
  - Velocity precision pushing below 1 m/s
  - Reaching (minimum) masses of a few Mearths
  - HARPS is reaching a rich population of hot Neptunes and hot Super Earths (Lovis et al):
    - 30% frequency, 5 to 30 Mearth, P < 50 days
- Kepler (and CoRoT)
  - Kepler on schedule for 16 Feb 2009 launch


Kepler
Field of
View
Deneb
Vega
LYRA
CYGNUS
Albireo
Altair
AQUILA

Kepler Mission Concept

- *Kepler Mission* is optimized for finding Earth-like planets (10 to 0.5 $M_{\oplus}$) in the HZ (out to 1 AU) of solar-like stars
- Monitor 100,000 main-sequence stars
- Use a one-meter Schmidt telescope: FOV >100 deg^2 with an array of 42 CCD
- Photometric precision: < 20 ppm in 6.5 hours for V = 12 solar-like star
  => 4σ detection for Earth-size transit
- Mission: Earth-trailing orbit for continuous viewing, ≥ 3.5 year duration, launch Feb 09





The Legacy of Kepler

- Frequency/characteristics of planets
  - Mass, radius, density, orbital distributions
    - Limited by ground-based follow-up velocities
  - Reaches down to Earth-sized planets
  - Reaches out to Earth-sized orbits
  - Host star characteristics
  - Information for the design of future missions

Beyond Kepler

- The sweet spot for Kepler is ~ 12th mag
  - Photometric performance ~ 20 ppm
  - Enough good targets to yield several transiting Earths
  - But too faint for JWST spectroscopy
  - Covers only 1/400 of sky
- CoRoT planets are even fainter
  - Smaller telescope, smaller area on sky is covered
- Need an all-sky survey for nearest & brightest!

Transiting Exoplanet Survey Satellite

- All-sky survey for transiting planets
  - 2.5-million selected targets $4 < I < 13.5$ mag
  - Emphasis on small stars including M dwarfs
  - Reaches Super Earth and even Earth-sized planets
  - Predicted yield of ~1600 planets
- The Legacy of TESS
  - All the brightest and nearest transiting planets
  - Best targets for follow-up studies by JWST and other future missions for years to come